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PAR 116

Distortion in Photo Duplication

18 March 1966

PROJECT AUTHORIZATION REQUEST

PAR 116
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SUBJECT: Distortion in Photo Duplication

TASK/PROBLEM

1. By the application of Moire' Techniques, study the effects and the degree of distortion produced in the current film handling systems during the duplication of photographic images.

INTRODUCTION

2. A limited study involving the use of Moire' Techniques has been completed under another contract. The study was directed toward the application of Moire' patterns as a tool to evaluate more accurately the degree of distortion introduced during printing. A vacuum frame and a continuous drum-type (Niagara) printer were used for this study. No other phases of the reproduction system were included in this effort. The results obtained from this work indicates a need to expand the use of Moire' patterns as a method for determining the image distortion introduced not only in printing but during processing, cleaning, titling, and through a composite system.

DISCUSSION

3. It is realized that dimensional distortions occur when duplicating photographic images. Although a distortionless system would be ideal, limited distortion can be tolerated if it is repeatable and the degree is well known. A promising method of measuring distortion is the application of Moire' techniques.

4. Moire' pattern analysis has been used successfully to study photographic distortions in the area of photogrammetry. In such studies, flat bed contact printing of sheet film was of primary concern, hence half-tone photographic glass plates could be used as original negatives to which all subsequent duplicates were referenced for analysis. Such methods, however, must be modified to include flexible support master negatives for use on drum platen printers and other roll handling equipment commonly found in aerial film laboratories.

5. A half-tone screen made on Estar base film can serve as a flexible support negative. A suitable negative can be prepared by contact printing from a master glass plate. Thereafter, it can be registered with the highly stable parent at any time to measure their dimensional differences. Subsequent printings of the flexible master can also be registered with the glass half-tone standard, hence a measured distortion can be adjusted for differences between the glass master and the flexible half-tone to yield a net distortion resulting from the duplication system.

APPROACH

6. It is proposed that tests be conducted using the Moire' technique to study the distortion characteristics of the following equipment items using 9.5-inch film:

a.	Trenton processor	-	Type 3404 film.
b.	Yardleigh processor	-	Type 3404 film.
c.	Dalton processor	-	Type 8430 film.
d.	Niagara printer	-	Type 3404/8430 film.
e.	Seneca printer	-	Type 3404/8430 film.
f.	Cleaner/Waxer	-	Type 3404 film.
g.	Titler	-	Type 3404 film.
h.	Composite system	-	Type 3404 film.

The above items will be evaluated under normal operating and environmental conditions.

7. The data computation required for analyzing Moire' measurements is lengthy and repetitious and usually calls for statistical analysis. Computer programs will be written to perform the calculations.

8. One method of presenting distortion data is the calculation of average distortion components in the length and width directions of the film. The results of these investigations will be presented in this manner. In addition, other techniques will be sought as a means of describing localized distortions and will be used where desirable.

9. Because distortion measurements are highly dependent upon ambient temperature and humidity, it is proposed that measuring equipment of the recording type be purchased to monitor the temperature and humidity prevailing in the test area. Test materials can then be conditioned in the room at known levels before distortion measurements are made.

10. It is the intent of this PAR to develop techniques and study the performance of the equipment items listed in paragraph 6 under limited but typical production type operating conditions. Although knowledge regarding the performance of each equipment item is valuable in itself, it is further intended that this investigation be directed to items requiring future exhaustive study and optimization of distortion characteristics.

PROGRAM OBJECTIVES

11. The objectives of this program are:

a. Develop techniques of using Moire' patterns to measure distortion of roll film handling equipment.

b. Develop methods presenting distortion measurements both overall averages and localized values.

c. Study the equipment specifically mentioned in paragraph 6, under limited but typical operating conditions.

SCHEDULE

12. A tentative schedule covering major phases of effort is shown in Figure 1. The time span indicated to complete the subject program is based on actual start of work. Upon approval to proceed and/or start of work, schedule will be reviewed and necessary changes reported as required.

TENTATIVE SCHEDULE

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Study Distortion in Photo Duplication

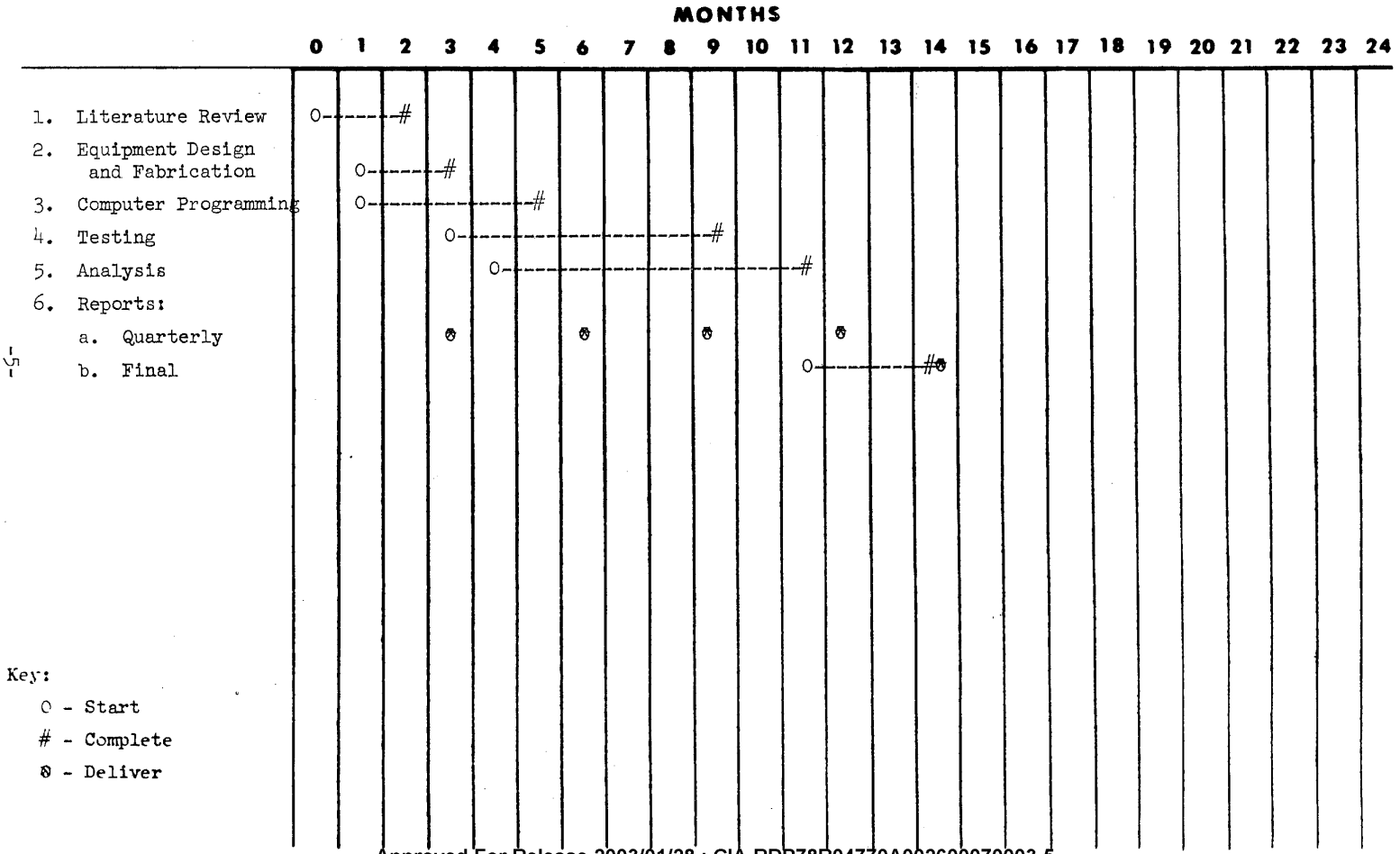

Figure 1